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Miniaturisation of an isothermal nucleic acid amplification system for HIV-1 viral load evaluation at point of care in low resource areas

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ABSTRACT

The purpose of this project is the design and evaluation of a miniaturized isothermal nucleic acid amplification system making use of readily-available and affordable technologies in order to amplify a given vRNA (viral-RNA) sample to detectable levels. The developed solution made use of low cost, simple thermocouple transducers along with a custom developed PCB which, when calibrated, was found to have a tolerance within 1°C, which is required for most nucleic acid based platforms. A PI controller was found to be sufficient to maintain the reagents in the developed microfluidic cassettes to the desired temperature. The nucleic acid amplification system chosen was the bioMerieux NucliSENS EasyQ HIV-1 v2.0 (bioMerieux, Lyon, France) since this was an isothermal amplification system with built in FRET (Fluorescence Resonance Energy Transfer) probe fluorescence capabilities combining both amplification and detection. This assay, however, was found to be unreliable with null results on all but one test limiting the evaluation of the developed microfluidic and temperature controller performances.